The Multimedia and Digital Video Technologies Group

Advanced Network Technologies Division
Information Technology Laboratory

National Institute of Standards and Technology

TECHNICAL AREAS **R&D PROGRAM**

Mission

The Multimedia and Digital Video Technologies Group (MDVTG) works with industry to promote the development of cost-effective, interoperable, distributed multimedia applications and to enable the development of digital video technologies for broadcast, interactive television, for video-on-demand, and for video conferencing. The main emphases of the group include:

(1) measurement techniques for characterization of distributed multimedia technologies and digital video devices and services;
(2) techniques for integrating multimedia services with network technologies; and
(3) industry-driven standards for multimedia technologies and digital video devices and services.

Adaptive Network Systems

The Internet has grown explosively over the last few years. As more and more sophisticated electronic commerce applications come on-line they are increasing the demands placed on the existing infrastructure and applications. The infrastructure is unable to keep up with the demands placed on it, which leads to an unacceptable degradation in performance. Research has focused on resource reservation to provide quality of service guarantees at the network level. NIST proposes new research focused on an application level adaptation strategy to deal with resource fluctuations and failures.

A complementary approach to resource reservation is to adapt an application dynamically to whatever resources are made available to it so as to minimize the application's "cost" while maximizing the application's performance. Adaptation can be achieved by several means. For example, one may adjust to congestion by altering sliding window sizes and to bandwidth limitations by compressing the stream. However, distributed applications may offer greater opportunities for adjustment. For example, one may dynamically reposition the computational and data-flow components of the distributed application to adapt to global resource availability to maximize end-to-end application performance.

As the sophistication of distributed applications over the Internet grows, there is an interest in providing resiliency both at the network and application level despite failures in processors or network links. This is especially important in failure sensitive applications, such as electronic commerce, where transactional semantics may be desired. It is the goal of project AGNI at NIST to design and build an infrastructure for re-configurable, flexible, fault-tolerant peer-to-peer systems and to build a set of applications that can exploit the infrastructure.

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DARPA IC&V

In the context of the Evaluation Working Group (EWG) of the DARPA Intelligent Collaboration and Visualization program, the MADVT Group is investigating the Automation of Testing of Collaboration Systems and developing new technologies supporting Fine-grained Distributed Logging and Monitoring.

The work of the EWG is directed towards the design and development of a collection of "scenarios" for use in evaluating collaboration systems. These scenarios may involve the use of up to dozens of distributed participants who must perform their "role" in the scenario. This process may be simplified and expedited and made regressive by using automated "scripts" in the place of participants. Finding or developing a system which will perform this task is the principle goal of this project.

The Group is also constructing tools for fine-grained distributed event logging and monitoring over the Internet along with Mitre Corp. The logger will provide an infra-structure so that collaborative tools under test may log information and expose the log selectively to distributed test drivers. The distributed test drivers take the place of participants in a collaborative environment. The distributed test tools may then examine the log and make scripting decisions on the basis of what they find. The logging tool will provide facilities for serialization an real-time-stamping of the log. Using the tool, distributed logging and testing will be integrated in one combined infra-structure.

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Java-based Multimedia Collaboration

As the Internet has gained popularity over the past decade, the need for collaborative multimedia conferencing and application sharing systems has risen significantly. Application sharing allows participants to view and interact with the same application (e.g., spreadsheet) during their conference. These systems are beginning to play large roles in research, education (e.g., distance learning) as well as businesses.

The goal of this project is to design and implement an adaptable and extensible architecture for plate-form independence multimedia conferencing and collaborative application sharing. Towards this goal, our architecture is broken down into three layers; conference information service, session management, and collaborative applications sharing.

JCE (Java Collaborative Environment), which is developed by the NIST and in collaboration with Old Dominion University, uses Java-based collaboration mechanisms that provide solutions to overcome the platform-dependency problems for collaborative computing in heterogeneous systems. Java's main feature, which is making it an increasingly popular programming language, is that the bytecodes that are produced can be run on any platform which has a Java Virtual Machine. This enables application developers to write the application once and have it run anywhere.

In JCE, mechanisms were developed to intercept, distribute and recreate the user events that allow Java applications to be shared transparently. All the Graphical User Interface (GUI) components defined in the standard java.awt package are extended in JCE to implement the mechanisms. It also includes libraries and utilities that deal with low level issues such as network communications (e.g., multicasting the data between the conference participants), conference management (e.g., joining and leaving a session), and floor control management. Session participants can have real-time interaction with each other and remotely work together as a team.

A more comprehensive description of the project, together with beta releases and demonstrations, are accessible via on the Group Web page. We are now in the process of extending JCE to include both audio and video in an integrated platform-independent desktop conferencing system.

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Streaming Synchronized Multimedia

Streaming multimedia over the web/video server is a fast emerging approach to play audio, video, dynamic image and text caption over the Intranet/Extranet/Internet. It provides live multicast ability and an instant replay (for archived clips) from a selected media stream rather than the traditional

approach, which requires downloading the entire clip before playing it. With synchronization, it pushes the streaming multimedia technology to an even higher level of capability. It allows streaming of multiple single media stream from either the same or different multimedia server down to the client, and the client synchronizes them into a single cohesive presentation. The advantages are:

- Flexibility – allows dynamic network adaptation, which provides automatic video resolution adjustment while providing good quality audio stream.
- Efficiency – allows playing single multicast video stream for clients listening to different language audio streams.

This project works closely with SMIL (Synchronized Multimedia Integration Language) specification of Synchronized Multimedia working group of W3C as well as applying the RTP (Real Time Transport Protocol) and RTSP (Real Time Transport Streaming Protocol) of IETF.

The basic research and development of Streaming Synchronized Multimedia will involve NIST in Intranet/Extranet/Internet multimedia and digital video technology standards efforts.

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DAVIC™
Digital Audio Visual Council

Interoperability Testing

Digital video services are expected to become a major business sector in the near future. Interoperability issues can be expected to arise as users begin to access these services through networks of different service providers using information appliances (e.g., set-top units) with various capabilities. These issues must be addressed at an early stage of the technology development.

NIST has established programs to foster interoperability of various products and services. Since Video-on-Demand (VoD) is recognized as one of the digital video services that will be commercially offered soon, a VoD Interoperability Testing Laboratory has been established by the Advanced Network Technology Division at NIST.

This laboratory has a reference VoD system that is based on the DAVIC (Digital Audio-Visual Council) specifications. DAVIC is an international consortium which specifies open interfaces and protocols based on established standards to foster the development of interoperable video products. Manufacturers of DAVIC compliant VoD products (e.g., set-top units and servers) are being encouraged to bring their prototype units into the NIST laboratory for testing. Testing will be conducted using the test methods and scenarios developed under this project. This facility will offer vendors the opportunity to test product interoperability with other vendors' products as well as with the NIST reference VoD implementation.

NIST added a Web extension to the DAVIC model to facilitate interoperabilty testing. In addition to using Web access, NIST implemented a VoD application in Java. A demonstration of this application was developed which uses Java in combination with NIST's software MPEG player or a PC-based hardware MPEG decoder. This project is conducted in collaboration with the High Speed Network Technologies Group.

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Federal EDI Secretariat

As part of the Federal Government initiative to implement Electronic Commerce, the National Institute of Standards and Technology (NIST) has been given the duties of configuration manager and administrator for the harmonization of Federal Electronic Data Interchange (EDI) Implementation Conventions.

The group acts as the Secretariat for Federal EDI, publishes the Federal Implementation Conventions, and maintains the Federal EDI Web site.

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General Information

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